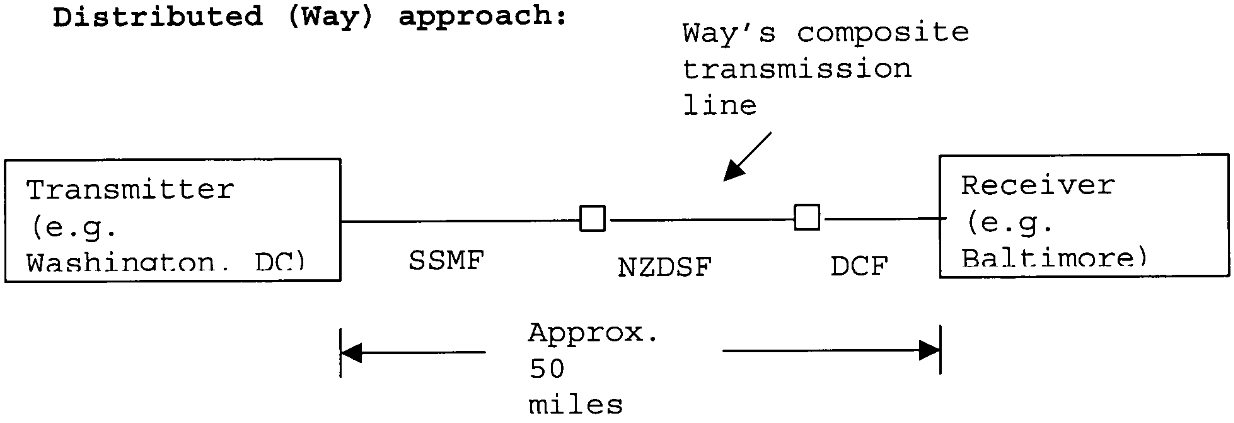
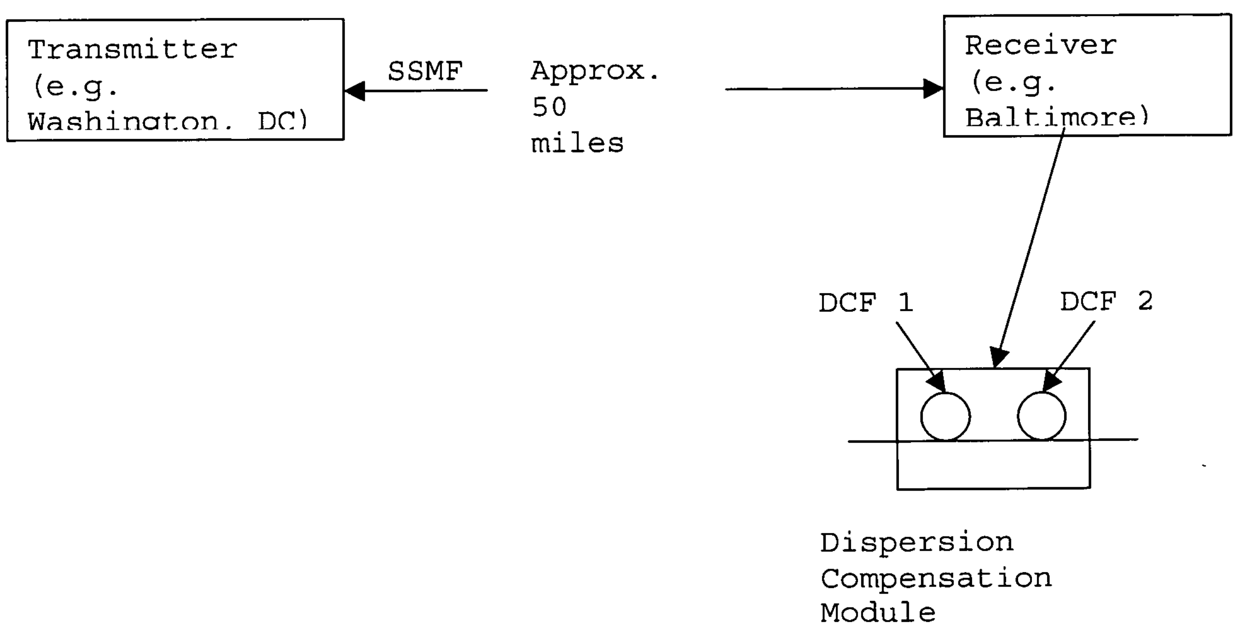
compensation module. A key difference between the distributed approach of Way and discrete approach of the present invention is better explained with the following diagrams.

Distributed (Way) approach:



The discrete (inventive) approach:



As the diagrams suggest, in Way's approach, the NZDSF and DCF fibers are physically part of the transmission line, the fibers are laid out so their physical length has a one to one correspondence to physical propagation distance.

In the present invention, however, the physical length of the DCFs **do not** have a one to one correspondence to physical propagation distance, since the DCFs are wound on a spool and sit in a discrete housing of a dispersion compensating module. One of the reasons this is important is that the invention is much more flexible and able to accommodate varying degrees of dispersion and dispersion slope just by adjusting the length(s) of the DCF(s) in the discrete module.

In contrast, Way may not be able to compensate for large amounts of dispersion caused by the SSMF fiber section since a the physically long length of DSF required to dispersion compensate may make the composite transmission line too long for reliable communication. Recall that the distance between amplifier or regeneration sites is limited (e.g. in some cases approximately 500km) to enable the receiver to convert the optical signal to an electrical signal with an acceptably low bit error rate.

Indeed, the problems being addressed by Way and the present invention are quite different. The Way patent is from a telecommunications carrier company (MCI WorldCom, Inc.). Telecom carriers such as MCI WorldCom build optical communications networks from the ground up and typically install their own optical fiber. For example, trenches may be dug by the carrier to install new optical fiber. Thus, carriers often have the liberty to specially design their optical fiber so as to minimize dispersion. Way is a good example of such a transmission

fiber design and relies upon the ability of a carrier to install the specially designed fiber along the transmission pathway in order to minimize dispersion.

In contrast, the inventors of the present application faced a quite different challenge. The inventors are employed by a telecommunications equipment provider that sells equipment to companies such as MCI WorldCom. Equipment providers are forced to deal with a previously installed route of optical fiber. In other words, the inventors could not install specially designed transmission fiber as in Way but had, nevertheless, a similar problem of minimizing dispersion and dispersion slope. Because the distributed approach (requiring installing new fiber) was not available, the inventors created a dispersion compensating module that could be installed along with the other telecommunications equipment such as optical receivers and optical add/drop multiplexers.

To further illustrate the differences between Way's distributed transmission line dispersion compensator and the presently claimed dispersion compensation module consider the following points:

1) The presently claimed invention has a clear demarcation between the transmission fiber (transmission path as claimed) and the dispersion compensating fibers in the module. The dispersion compensating fibers **discretely** compensate for the dispersion and slope of the transmission fiber. Way's patent treats the fiber as one entity with different pieces compensating for dispersion of the other pieces. In fact if the composite fiber link suggested by Way et al fails to practically provide complete dispersion and slope compensation, one could install the inventive dispersion compensation module as a discrete solution to the composite link to mop-up residual dispersion and slope.

2) The reason that the distributed approach of Way might fail is as follows. For a given location A in Washington DC and a given location B in Baltimore, the physical distance between A and B will always remain constant, and let us assume it to be 77km. The approach suggested by Way requires us to pick lengths (l1, l2, and l3) such that sum of these lengths (l1+l2+l3) is equal to 77km. If the dispersion and slope coefficients of the available fibers do not co-operate with the lengths to satisfy the equation, we have no solution. That is for a given choice of fibers, if the residual dispersion and dispersion slope is zero only for l1 +l2 +l3 = 83km, we have to either physically move the location A (or B) or allow for non-zero residual dispersion and slope. Physically moving the location A (or B) is not an option in most cases as the locations are typically at network operations centers (NOCs), telecommunications nodes, etc where electrical power and physical access is available. In present invention, the lengths of DCF fibers are wound on spools. If more DCF is needed to satisfy a dispersion condition, simply wind more DC fiber onto a fatter spool in the dispersion compensating module.

3) The comparison drawn by the Office Action between the inventive N fiber solution to the four-wave mixing effect described by Way is incorrect. Four-wave mixing is a parametric effect where three optical waves (frequencies) collaborate to generate a fourth new optical wave (frequency). Way has suggested that his approach of making a composite distributed dispersion managed transmission line will be helpful in suppressing the four wave mixing effect. The inventors suggest that their N fiber approach will be helpful to suppress residual dispersion and dispersion slope (not four-wave mixing) and as such has nothing to do with four-wave mixing. In fact four-wave-mixing efficiency

depends on the dispersion coefficient of the individual transmission fiber and not on the residual dispersion and dispersion slope after compensation.

The Office Action also makes other assertions that are incorrect and not supported by Way. Namely, the Office Action asserts that:

> "one skilled in the art would clearly have recognized that the dispersion compensating fibers of Way could have either been housed in either single modules or separate dispersion modules. Way teaches that the dispersion compensating fibers of the invention, although separate or discrete, could be integrated [sic] other modules and with each other." (page 4, last paragraph of June 26, 2002 Office Action)

Although Way does mention putting the single DCF in the receiver, Way certainly does not disclosure or suggest putting any of the other parts of the composite transmission fiber in a discrete module such as a receiver. Indeed, such a modification would result in a nonviable solution. As pointed out above, Way's NZDSF and DCF fibers are physically part of the transmission line such that the fibers are laid out so their physical length has a one to one correspondence to physical propagation distance. In other words, spooling up with NZDSF fiber in a discrete module along with the DCF would lead to a nonviable solution because much of the available transmission distance (fiber) would be on a spool in the receiver thereby drastically reducing the physical distance to the next optical node (e.g. in most cases, an amplifier). Recall that the NZDSF fiber section is a large percentage of the total length (e.g. 45% as discussed in column 15, lines 24-39 and column 16, lines 55-60). Thus, placing a major percentage of the transmission fiber on a spool of a discrete module is not a viable solution.

In view of the above amendments and arguments, applicants respectfully request reconsideration and withdrawal of the Way art rejections.

Conclusion

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Michael R. Cammarata (Reg. No. 39,491) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 50-0308 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

By____________________
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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claims 6 and 9 have been canceled.

The claims of the invention has been amended as follows:

1. (Amended) A[n] dispersion compensation module compensating for dispersion in an optical communications network transmitting signals on multiple wavelengths, the [optical communications network] dispersion compensation module comprising:

a first dispersion compensating fiber providing dispersion compensation and dispersion slope compensation, said first dispersion compensating fiber having a first non-zero dispersion coefficient and a first non-zero dispersion slope coefficient;

a second dispersion compensating fiber in optical communication with said first dispersion compensating fiber, said second dispersion compensating fiber having a second non-zero dispersion coefficient and a second non-zero dispersion slope coefficient, a length of said first dispersion compensating fiber and a length said second dispersion compensating fiber are selected to compensate dispersion and to compensate dispersion slope simultaneously for the multiple wavelengths in a transmission path in optical communication with said first dispersion compensating fiber and said second dispersion compensating fiber.

2. (Amended) The <u>dispersion compensation module</u> [optical communications network] of claim 1 wherein the first non-zero dispersion coefficient is different from the second non-zero dispersion coefficient.

3. (Amended) The <u>dispersion compensation module</u> [optical communications network] of claim 1 wherein the first non-zero dispersion slope coefficient is different from the second non-zero dispersion slope coefficient.

4. (Amended) The <u>dispersion compensation module</u> [optical communications network] of claim 1 wherein the transmission path is an inter-network element section of transmission fiber <u>optically coupling the dispersion compensation module and a node of the optical communications network</u>.

5. (Amended) The <u>dispersion compensation module</u> [optical communications network] of claim 4 wherein the transmission path includes a component in optical communication with the inter-network element section of transmission fiber.

~~6. The optical communications network of claim 4 wherein said first dispersion compensating fiber and said second dispersion compensating fiber are housed in a single dispersion compensation module.~~

7. (Amended) The <u>dispersion compensation module</u> [optical communications network] of claim 1 wherein the transmission path extends between a first terminal [to] <u>and</u> a second terminal to define a terminal-to-terminal path <u>and the dispersion compensation module is optically coupled to the second terminal</u>.

8. (Amended) The dispersion compensation module [optical communications network] of claim 7 wherein the transmission path includes a component in optical communication with the terminal-to-terminal path.

~~9. The optical communications network of claim 7 wherein said first dispersion compensating fiber and said second dispersion compensating fiber are housed in separate dispersion compensation modules.~~

10. (Amended) The dispersion compensation module [optical communications network] of claim 1 wherein the length of first dispersion compensating fiber and the length of second dispersion compensating fiber are selected based on a mathematical solution compensating dispersion in the transmission path and compensating dispersion slope in the transmission path.

11. (Amended) The dispersion compensation module [optical communications network] of claim 10 wherein the mathematical solution is represented as:

$$D_{trans} * L_{trans} + D_{dcf1} * L_{dcf1} + D_{dcf2} * L_{dcf2} = 0$$

$$L_{trans} * S_{trans} + L_{dcf1} * S_{dcf1} + L_{dcf2} * S_{dcf2} = 0$$

where D is dispersion coefficient, L is length and S is dispersion slope coefficient.

12. (Amended) The dispersion compensation module [optical communications network] of claim 11 wherein the length of first dispersion compensating fiber and the length of second dispersion compensating fiber are selected based on discrete lengths approximating the mathematical solution.

13. (Amended) The dispersion compensation module [optical communications network] of claim 10 wherein the mathematical solution compensates for Nth order dispersion effects in the transmission path, where N is greater than 2,

said dispersion compensation module further comprising N dispersion compensating fibers, including said first and second dispersion compensating fibers, in optical communication with each other, each of said N dispersion compensating fiber having a non-zero dispersion coefficient and a non-zero dispersion slope coefficient, wherein respective lengths of said N dispersion compensating fibers are selected to compensate 1^{st} through N^{th} order dispersion effects for the multiple wavelengths in the transmission path.

14. (Amended) The dispersion compensation module [optical communications network] of claim 10 wherein the mathematical solution includes a value representing dispersion introduced by components in the transmission path.

15. (Amended) The dispersion compensation module [optical communications network] of claim 10 wherein the mathematical solution includes a value representing dispersion slope introduced by components in the transmission path.

16. (Amended) A method for compensating dispersion in an optical communications network transmitting signals on multiple wavelengths using a dispersion compensation module, the method comprising:

providing a first dispersion compensating fiber having a first non-zero dispersion compensation and first non-zero dispersion slope compensation in the dispersion compensation module;

providing a second dispersion compensating fiber having a second non-zero dispersion compensation and second non-zero dispersion slope compensation in the dispersion compensation module; and

optically coupling the dispersion compensation module to a transmission path of the optical communications network;

said first non-zero dispersion compensation, first non-zero dispersion slope compensation, second non-zero dispersion compensation and second non-zero dispersion slope compensation selected to compensate dispersion and compensate dispersion slope simultaneously for the multiple wavelengths in a transmission path.

19. (Amended) The method of claim 16 wherein the transmission path is an inter-network element section of transmission fiber optically coupling the dispersion compensation module and a node of the optical communications network.

21. (Amended) The method of claim 16 wherein the transmission path extends between a first terminal [to] and a second terminal to define a terminal-to-terminal path, said optically coupling step optically coupling the dispersion compensation module to the second terminal.

26. (Amended) The method of claim 23 wherein the mathematical solution compensates for Nth order dispersion effects in the transmission path, where N is greater than 2, said providing steps providing N dispersion compensating fibers having non-zero dispersion compensation and non-zero dispersion slope compensation in the dispersion compensation module, wherein the dispersion compensating fibers are selected to compensate 1st through Nth order dispersion effects for the multiple wavelengths in the transmission path.